

REMARKS

Claims 1-31, 97 and 98 are pending. An RCE and Correspondence to the Examiner is concurrently filed herewith. Applicants respectfully request reconsideration of the above-referenced application in light of the following remarks and concurrently filed documents.

In the Office Action dated July 16, 2003, claims 1-31 and 98 were rejected under 35 U.S.C. § 102(e) as anticipated by Agarwal. Reconsideration is respectfully requested.

The claimed invention relates to a capacitor structure with an annealed top conducting layer to reduce capacitor current leakage. In the prior art, only the dielectric layer was annealed to fill in oxygen vacancies and not the top conducting layer.

As such, independent claim 1 recites a “capacitor for a semiconductor device . . . comprising a bottom conducting layer, a dielectric layer . . . and an annealed top conducting layer . . . comprising an oxygen permeable material.” (emphasis added). Similarly, claim 98 recites a “capacitor for a semiconductor device . . . comprising a bottom conducting layer, an annealed dielectric layer . . . and an annealed top conducting layer . . . comprising a metal oxide permeable to oxygen.” (emphasis added).

The Office Action dated July 16, 2003 asserted that “applicant is directed to column 6, lines 54-56, where Agarwal’s invention includes heat treatment that indeed applies to the top layer 70.” (Office Action, pg. 5). However, Applicants respectfully submit that Agarwal fails to teach an annealed top conducting layer.

Column 6, lines 54-56 of Agarwal merely discloses that, “CVD, PVD, sputtering, evaporation, or other suitable means may be used to form the upper electrode 70, and the means chosen will vary depending on the desire structure.” Agarwal discloses only heat treating the dielectric layer 72. Agarwal merely teaches that “[t]he dielectric layer 72 is . . . treated by exposing it to a high temperatures (300 to 1100 degrees Celsius)

for a period of time sufficient to drive water and solvent out of the layer and to form a hard dielectric layer 72." (Col. 6, lines 32-47) (emphasis added). After forming the hard dielectric layer 72, "the upper electrode 70 is formed on the dielectric layer." (Col. 6, lines 48-50). Agarwal does not teach annealing the top layer 70 as the Office Action dated June 16, 2003 asserts. Agarwal's dielectric layer 72 is treated at a high temperature and not the upper electrode 70. In other words, Agarwal merely teaches a conventionally formed top layer 70.

In Applicants' FIG. 2, a graphical comparison of the current leakage of a stacked capacitor before and after the top conducting layer is annealed is illustrated. As FIG. 2 illustrates, the capacitance of the capacitor before the top conducting layer is annealed was approximately 21 femto-Farad per micrometer squared (" fF/μ^2 "). This is analogous to the structure that Agarwal discloses since Agarwal's upper electrode 70 is not annealed. However, as FIG. 2 further illustrates, the capacitance of the capacitor after the top conducting layer is annealed was reduced by a factor of approximately 10.

Moreover, in Applicants' FIG. 3, two samples with a top conducting layer annealed in Nitrogen gas was graphically compared to two samples with a top conducting layer annealed in Oxygen gas. The current leakage density for the capacitors annealed with Nitrogen gas produced current leakage that exceeded 2000 amperes per centimeter squared (A/cm^2). In contrast, the two capacitors annealed with Oxygen gas yielded current leakage density reductions by a factor of 10 to 100 times of the Nitrogen gas samples.

Accordingly, Applicants' claimed "annealed top conducting layer . . . comprising an oxygen permeable material," is not anticipated by Agarwal. Agarwal does not teach annealing the upper electrode 70. Agarwal merely discloses a conventionally formed upper electrode 70. For at least these reasons, withdrawal of the rejection for claims 1 and 98 is respectfully requested. Claims 2-31 depend from independent claim 1 and are similarly allowable.

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In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

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